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## Isotogastruridae, a new family of terrestrial interstitial Collembola from the Lesser Antilles

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**Abstract.** Description of a new family of Collembola intermediate between Poduromorpha and Entomobryomorpha. The new monospecific genus was found in terrestrial interstitial fine sands of beaches from Martinique (French West Indies) and Saint Christopher (British West Indies).

**Key words.** Collembola, new family, Martinique, Saint Christopher, fine sands.

### Introduction

The senior author has recently published studies of Collembolan interstitial terrestrial, littoral and continental, communities of fine sands from the Mediterranean region (1985, 1989, 1992), central Europe (1986, 1988, 1991, 1992) and Namibia (1988).

We have started a similar study of the fine sands of several Caribbean islands and in this paper we describe a new family of Collembola, intermediate between the Poduromorpha and Entomobryomorpha uncovered during these studies.

The sampling technique used was soil washing and sorting the floating organisms under a dissection microscope.

### Isotogastruridae fam. n.

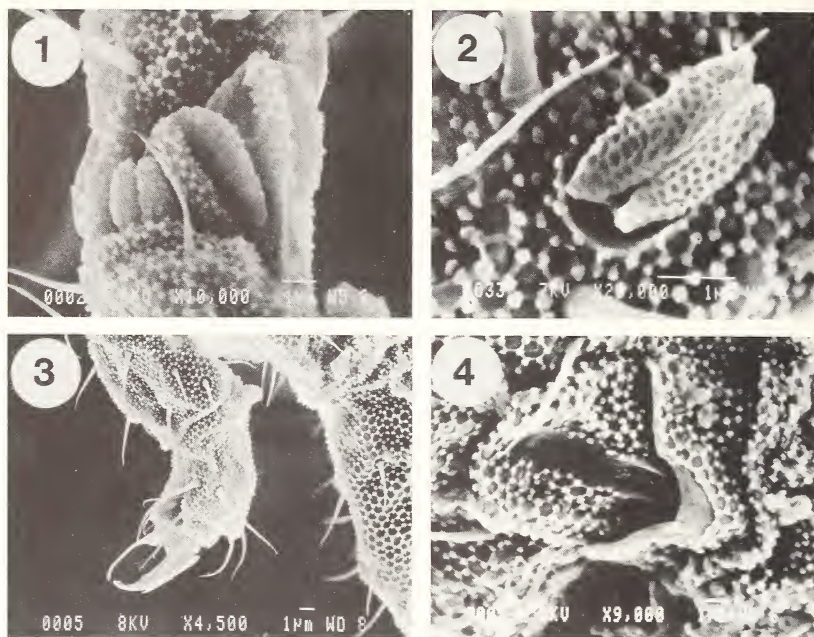
Small springtails (0.3—0.4 mm), with a prognathous and square head and elongate body. Prothoracic tergite well developed, but lacking setae. Body segments from thoracic segment II through abdominal segment IV subequal in length. Chaetotaxy primitive. Without microsensilla *s'* on thoracic segment II and III. A unique complex sensory organ present on the basal part of the dorsum of fourth antennal segment. Postantennal organ, pseudocelli and scales absent. Dorso-median cuticular expansions present on thorax and abdomen. Anterio-median part of abdominal tergite V with a glandular opening.

### *Isotogastrura* gen. n.

**Diagnosis:** Prothoracic tergite without seta, as in Entomobryomorpha but well individualised, as in Poduromorpha. Body segments, from thorax II through abdomen VI segments subequal in length and distinct, as in most Poduromorpha and Isotomidae.

Primitive chaetotaxy (Yosii 1961), recalling the conditions in the family Hypogastruridae. Three rows of setae on the dorsum of each segment from thorax II to abdomen VI. The microsensilla *s'* on thorax II and III lacking. Anal spines, scale and pseudocelli absent.

Primary integumentary granules small, arranged in hexagons. Dorso-median cuticular expansions on all segments except abdominal segments IV and VI. A glandular opening partly covered by an integumentary fold present on the anterio-median portion of abdominal tergite V.



Figs 1—4: *Isotogastrura arenicola* gen. n., sp. n. 1) dorso-basal sensory organ of antennal segment IV. 2) sensory organ of antennal segment III. 3) leg III. 4) glandular opening of abdominal tergite V.

Fourth antennal segment without apical vesicle and with well developed sensillae and an additional dorso-basal complex sensory organ. Third antennal segment sense organ with two simple dorsal sensillae with a single base and a lateral microsensilla.

Buccal parts of chewing type.

Corneae present. Postantennal organ absent.

Legs short. Basal part of tibiotarsus III, in both sexes, with a cuticular expansion. Claws with a dorsal spine and a long empodial appendage.

Furca short but well individualised. Tenaculum present.

Small size. Psammobiotic.

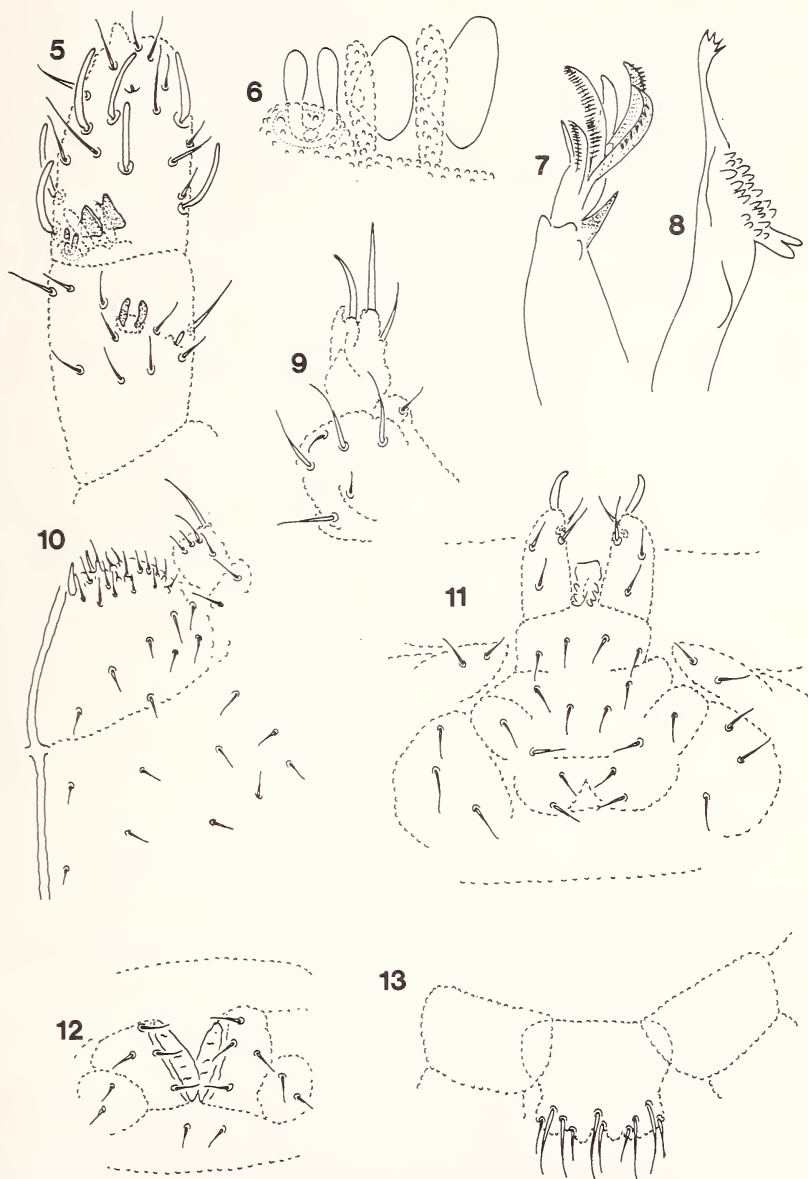
Type species: *Isotogastrura arenicola* gen. n., sp. n.

### *Isotogastrura arenicola* sp. n.

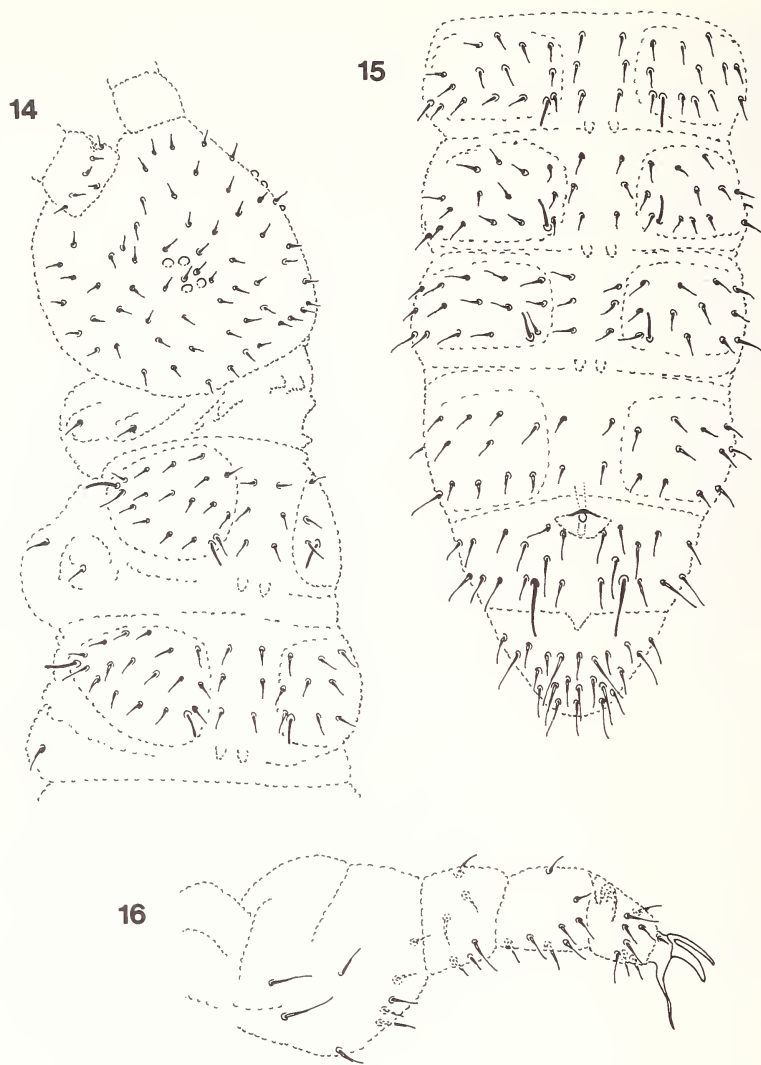
Description: Holotype length 0.4 mm, length of paratypes between 0.3 and 0.4 mm. Colour in alcohol pale grey-bluish. Pigment granulated, uniformly distributed over dorsal areas except for the darker eyepatches.

Two pairs of dorso-median cuticular expansions in the middle of thoracic segment I, one pair in the posterior margin of thoracic segment II through abdominal segment III and a single one in the posterior margin on abdominal segment V (Figs 14, 15, 17). A single dorsal glandular opening, partly covered by an integumentary fold, of the antero-median part of abdominal segment V (Figs 4, 15).

Antennal segments III and IV clearly separated. Antennal segment IV with 7 long subcylindrical sensillae, without microsensilla, with a subapical "organit" and a complex dorso-basal sensory organ consisting of one thick short finely granulated sensilla with two lobes, two fine-



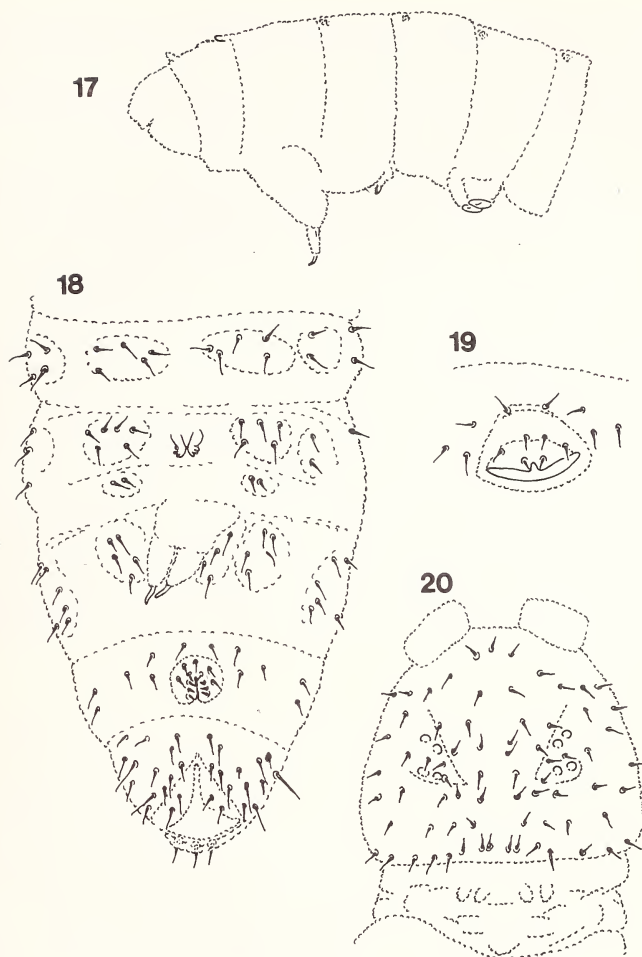
Figs 5—13: *Isotogastrura arenicola* gen. n., sp. n. 5) antennal articles III—IV, dorsal side. 6) dorso-basal sensory organ of antennal segment IV. 7) maxilla. 8) mandible. 9) maxillary palp. 10) labium. 11) furca. 12) ventral tube. 13) labrum.



Figs 14–16: *Isotogastrura arenicola* gen. n., sp. n. 14) dorsal chaetotaxy of the head and thorax. 15) dorsal chaetotaxy of the abdomen. 16) leg III.

ly granulated fan-shaped sensillae and two elongate expansions with normal integumentary granulation (Figs 1, 5, 6). Apical vesicle lacking, apical epicuticular expansion present. Remaining setae simple. Sensory organ of third antennal segment consisting of two sensillae with alveolar surface and arising from a single base with lateral microsensilla and no guard sensilla (Figs 2, 5). Antennal segments I and II with 7 and 11 setae respectively. Ratio of antennal segments I:II:III:IV = 1:1:1.4:1.5. Ratio of antenna: cephalic diagonal = 1:1.15.

Head square with 4 + 4 corneae, corresponding to posterior corneae E, F, G and H (Fig. 20). Postantennal organ absent.



Figs 17—20: *Isotogastrura arenicola* gen. n., sp. n. 17) thorax III — abomen VI in profile. 18) ventral chaetotaxy of abdomen II—VI. 19) genital plate ♀. 20) head and thorax I, dorsal side.

Buccal cone long and square. Mandible slender with a reduced molar plate and four apical teeth (Fig. 8). Maxilla very elongate with 6 slender ciliate lamellae, and a long narrow unidentate claw (Fig. 7). Maxillary palp, labrum and labium as figs 9, 13, 10.

Legs short. Tibiotarsi I, II, and III with 12, 12 and 11 setae respectively, without tenent hair; basal part of tibiotarsus III, in both sexes, with one cuticular dorso-external expansion. Small and sharp claws, without internal and lateral teeth, but with a long dorsal spine; empodial appendages with an elongated filament passing beyond apex claws (Figs 3, 16).

Ventral tube with 6 + 6 setae (Fig. 12). Tenaculum with 3 + 3 teeth, without seta on the corpus. Furca short. Manubrium with 16 anterior setae. Dens with 4 setae, one of which is latero-ventral. Mucro slender, hook-shaped (Fig. 11). Manubrium: dens: mucro ratio = 5:2.5:1.



Dorsal chaetotaxy very similar to that seen in Hypogastruridae (Figs 14, 15). It is formed of mesochaetae and some macrochaetae especially in the posterior region. Some characteristic features are:

Head: a0, v3 present; c1 absent (Fig. 20).

Thorax: Thorax I without seta. Thorax II and III with 3 complete rows of setae; sensory setae in position m7 and p3; without lateral microsensilla s' (Fig. 14).

Abdomen: Abdomen I—VI with 3 rows of setae. Abdomen I, II and III with sensory setae in position p3. Abdomen IV with 3 rows of setae while m-row is reduced; sensory setae absent. Abdomen V with a long sensory seta in position p2. Abdomen VI with 3 rows of setae, with 3 median setae (a0, m0, p0), without anal spines (Fig. 15).

A special character is, in both sexes, the presence on the antero-median part of abdominal tergite V of a glandular opening (Figs 4, 15).

Thoracic sternites without seta. Ventral abdominal chaetotaxy (abd. II—VI) as in fig. 18.

Genital plate ♂ and ♀ as in figs 18, 19.

Holotype: ♂, MARTINIQUE, fine sand, supra-littoral zone, beach of Anse d'Arlet, 19. V. 1989 (Thibaud) (MNHN).

Paratypes: 1 ♂, 1 ♀, 1 juv. and 6 ex. in alcohol, MARTINIQUE, fine sand, supra-littoral zone, beach of Anse d'Arlet, 19. V. 1989 (Thibaud) (MNHN).

Other material. 3 ♂, 1 ♀, MARTINIQUE, fine sand, supra-littoral zone, beach of Grande Anse d'Arlet, 19. V. 1989 (Thibaud) (MNHN). 3 ♂, 1 ♀, and 1 ex. in alcohol, MARTINIQUE, fine sand, supra-littoral zone, beach of Sainte Marie, 21. V. 1989 (Thibaud) (MNHN). 1 ♀, MARTINIQUE, fine sand, supra-littoral zone, beach of Anse Turin, 23. V. 1989 (Thibaud) (MNHN). 1 ♂, 2 ♀, MARTINIQUE, fine sand, supra-littoral zone, beach in south of Prêcheur, 23. V. 1989 (Thibaud) (MNHN). 3 Juv., SAINT CHRISTOPHER (SAINT KITTS), sand, supra-littoral zone, beach near Friars Bay Estate, S. E. of island, 10. VI. 1991 (Thibaud) (MNHN).

### Phylogenetic relations of the new family Isotogastruridae

By virtue of their well developed non-setaceous prothorax, the Isotogastruridae fit in the middle of the Arthropleona, intermediate between and separated from the Poduromorpha and Entomobryomorpha. They resemble the Poduromorpha and the Isotomidae in their isomorphic body segments and the Hypogastruridae in their primitive chaetotaxy. They are separated from both these groups, as well as other Poduromorpha, by the absence of the microsensilla s' on thoracic segments II and III.

Thus the Isotogastruridae represent a "hinge" family between the Poduromorpha and Entomobryomorpha. This unique monospecific genus is also distinguished by a supplementary sensory complex on the fourth antennal segment as well as the presence of a dorsal-medial cuticular expansion on the body segments. Additionally, this genus is also characterized by a specular glandular opening on abdominal tergite V, unknown in all other Collembola.

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We are indebted to Prof. K. Christiansen, Grinnell College, Iowa, USA, Dr. E. Christian, Universität für Bodenkultur, Wien, Austria and Dr. W. M. Weiner, Institute of Systematic and Evolution of Animals, Krakow, Poland, who corrected our translation and gave critical comments to the manuscript. We should like to thank J. Boudinot and J.-J. Menier for their help in the scanning photo realised in our laboratory.

### **Zusammenfassung**

Beschreibung einer neuen Collembolenfamilie, die sich zwischen Poduromorpha und Entomobryomorpha situiert. Die neue Gattung mit nur einer Familie wurde im terrestrischen Interstitiel des feinen Litoralsandes auf Martinique und Saint Christopher (Kleine Antillen) gefunden.

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